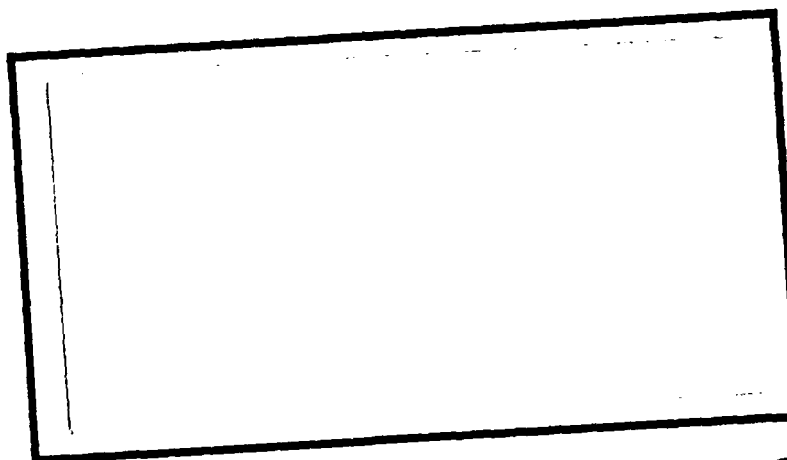


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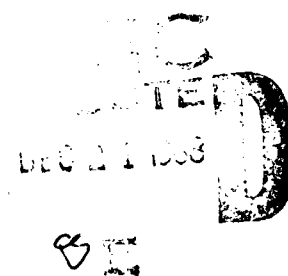
AFIT/GLM/LS/88S-12

A STUDY TO ANALYZE THE DEGREE
OF THE RELATIONSHIP BETWEEN
HEALTH PRACTICES AND FATIGUE

THESIS

Sherry L. A. Kennedy
Captain, USAF

AFIT/GSM/LS/88S-12



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BETWEEN HEALTH PRACTICES AND FATIGUE

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Systems Management

Sherry L. A. Kennedy, B.S.
Captain, USAF

September 1988

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Abstract

It is important for personnel within the DOD to be aware of how stress combined with various health practices may be causing or adding to the level of fatigue one experiences. If fatigue is controlled, the result may be better overall work performance and efficiency.

The intention of this research was to examine the health practices of higher ranked individuals, both military and civilian, at Aeronautical Systems Division to determine if a relationship exists between the health practices they are following and the amount of fatigue they are experiencing. The health practices studied were: alcohol consumption, caffeine consumption, amount of exercise, eating habits, sleeping habits, smoking habits, and psychological stress management. These seven health practices were analyzed and compared to the amount of fatigue being experienced for both psychological and physiological fatigue. The level of fatigue was determined by individual responses to subjective self-analysis questions. Comparisons were also made between military and civilian

personnel to determine if significant difference existed in health practices or in levels of fatigue.

Results of the study showed that various health practices have a direct, significant relationship with both psychological and physiological fatigue. In addition, certain health practices had considerable differences in responses for those with low fatigue when compared to those with high fatigue.

The data also indicated there was no significant difference in the fatigue levels of military and civilian personnel. Furthermore, only one health practice, strenuous physical activity, was significantly different between the military and civilian groups.

Finally, the respondents' comments suggest they can control the fatigue they feel by following certain health practices. A large percentage reported they knew when fatigue was operating, what its effects were, and how to go about handling it.

A STUDY TO ANALYZE THE DEGREE OF THE RELATIONSHIP BETWEEN HEALTH PRACTICES AND FATIGUE

I. Introduction

Overview

Chapter I introduces the reasearch to be conducted by first describing the general issue of concern and then the specific problem to be examined. The research hypothesis and investigative questions to help solve the research problem will follow, along with the scope of the study and a few of its limitations.

General Issue

Positions with significant responsibilities within the Department of Defense (DOD) for military members and civilian personnel are sometimes of a very critical nature and are highly visible to the general public. The amount of fatigue these individuals are under because of factors influencing their health and happiness may be affecting their performance. It is important for personnel within the

DOD to be aware of how stress combined with various health practices may be causing or adding to the level of fatigue one experiences. If the fatigue is controlled, the result may be better overall work performance and efficiency by DOD members.

Specific Problem

The purpose of this research is to first investigate if there is a relationship between fatigue and various health practices of DOD personnel. Then, second, to analyze to what degree health practices play in affecting the fatigue amounts. This second purpose has great importance because it is not well known which health practices cause fatigue, which keep it at a minimum, and which are unrelated. Third, to determine if health practices and fatigue levels are the same for DOD civilians and military personnel.

Research Hypothesis / Questions

To solve the proposed research problem, the following hypothesis and investigative questions will be analyzed.

A. The research analysis will attempt to reject the following null hypothesis:

There will be no relationship between various health practices followed to the amount of fatigue being experienced.

B. The following investigative questions will be pursued to help determine if the above hypothesis should be rejected or not:

1. Are the following health practices related to the amount of fatigue being experienced?

- a) alcohol consumption
- b) caffeine consumption
- c) amount of exercise
- d) eating habits
- e) sleeping habits
- f) smoking habits
- g) psychological stress management

2. How does the fatigue level of military personnel compare to that of civilian personnel?

3. What are the major differences in the health practices followed by military personnel as compared to that of civilian personnel?

4. What are some of the health practices followed by those reporting minimum amounts of fatigue?

5. How does the use of psychological stress management versus the other health practices relate to the amount of fatigue being experienced?

6. What is the level of awareness of both military and civilian personnel as to knowing when fatigue is operating and the related effects of one's fatigue?

Scope and Assumptions

Although there are many types of health practices, this research will only focus on the seven health practices listed under the first investigative question. The study will only encompass upper management personnel in the rank of major through colonel for military and GM/GS 13-15 for civilians. This population was selected based on the assumption that the health practices of these individuals are more routinized and consistent and that their overall levels of fatigue will be somewhat greater than their subordinates. This research will attempt to investigate the awareness of fatigue being experienced based on the members subjective perception of various relative-type questions. The majority of health practices investigated will be of a physiological nature, with stress management the only psychological dimension being discussed.

The intention of this research is to assess the relationship between health practices and fatigue in the target population only, with no intention to extend any

results to the Department of Defense as a whole. This extension may be done in future studies upon gaining information from this research.

Summary

Chapter I provided an overview of the need for this research; namely, a potential problem may exist in top level DOD activity because fatigue, influenced by health practices, could be impacting job performance. Chapter II will present a review of the literature in the area of fatigue. Some of its causes and effects, along with how health practices affect fatigue will be discussed. This chapter will also provide government related research in this area. Chapter III will then describe the methodology for this study and how the data will be used to address the hypothesis and investigative questions. Chapter IV will include an analysis of the results and Chapter V will discuss the major findings and provide recommendations for future research.

II. Literature Review

Overview

This chapter provides a description of what is considered fatigue in the language of physiology and its relationship to health practices. The literature review will consist of a detailed background exposition of the causes and effects of fatigue, followed by what the literature suggests are ways to alleviate this syndrome. Then, examples from previous studies of fatigue undertaken by government personnel will be discussed. This review of the literature attempts to emphasize to the reader that there is a direct relationship between various health practices and fatigue. What will be more difficult to prove is the degree or impact the health practices have on different individuals.

Background

Fatigue is the condition of weakness or weariness caused by long-continued strain and exertion of energy. Physiological fatigue is the sensation of having insufficient energy to carry on. This sensation of weariness is a result of either bodily or mental exertion extended over a period of time. If there are more energy

drainers than energy boosters, then there will be an energy shortage resulting in fatigue. Once the causes and effects of fatigue are identified, then the right steps can be taken to balance out the shortage. More specifically, energy needs to be consumed to counter balance energy being expended (2:23-25).

Fatigue is a result of stressful life situations and health practices followed during times of stress. "Stress is an adaptive response, mediated by individual characteristics and/or psychological processes, that is a consequence of any external action, situation, or event that places special physical and/or psychological demands upon a person" (7:30). Initially, stress is a benefit. However, excess stress prolonged over time will cause fatigue.

"A certain level of stress is needed for people to be productive; beyond a certain threshold, however, stress impairs performance" (7:31). Every person will experience stress at various levels. What affects a person in one way may affect a different person in a very different way.

"Everyone has an optimum stress level" (17:185). If the stress is kept below this optimum level, then a person can cope with the stress being experienced. How a person copes

with stress is very important to the level of problem the stress can cause to that person (17:185).

Cause of Fatigue. Prolonged stress, leading to fatigue, has many causes. Each individual needs to identify what causes his or her own fatigue. Some so called 'life events' may contribute to fatigue. The Holmes-Rahe Scale of Stress Ratings is a list of these events and provides a guideline for measuring stress. Some of these events are death of a spouse, divorce, marriage, dismissal from work, change in residence, and change in financial status. Each of these are assigned a rating. The ones pertaining to an individual are totaled and the higher the score the more stress one could be experiencing (10:45-51).

Another possible contributor to fatigue is aggressive and competitive behavior. This type of personality has the well known label of "Type A" behavior (7:31).

There are also social factors which contribute to fatigue. Two of these factors are economic situation, and family demands and relationships. A person's work situation also plays a great part in the amount of stress occurring. Such things as the nature of the job, the role in the organization, career development, work relationships, and

organizational structure could also affect the incidence of stress resulting in fatigue (7:32).

Finally, habitual bad health practices may cause additional fatigue because they are energy drainers. These bad health practices include smoking, excessive alcohol and caffeine consumption, bad diet, lack of sleep, and lack of physical exercise (2:24). How these practices contribute to fatigue will be discussed later in this chapter.

Effects of Fatigue. Each person is affected by stress differently. It is one's reaction to stress that will help decrease or increase the sensation of fatigue. There are physical symptoms as well as mental symptoms. During chronic stress, some of the following natural hormonal responses may occur: 1) Release of cortisone from adrenal glands may reduce the body's resistance to illness. 2) Increase in the thyroid hormone in the bloodstream may cause weight loss, shaky nerves, and insomnia. 3) Continued stress causes constant releases of endorphin, similar to morphine, which may deplete its supply, leading to migraines and backaches. 4) The digestive tract may shut down, resulting in stomach and intestinal problems. 5) There may be a release of sugar into the blood along with insulin to

metabolize the sugar. This will increase energy at first, but may aggravate diabetes due to the demand for insulin.

6) High levels of stress cause the heartbeat to race, possibly leading to high blood pressure, strokes, and heart attacks. And finally, 7) one additional effect of stress is that the five senses may become more acute, causing the senses to burn out and become less efficient (10:22-35). Symptoms 2-4 will likely have been experienced by many of the readers of this thesis.

Normal stress acts as an energizer. However, prolonged stress gradually exhausts one's physical and mental resources. This is often described as "burnout." Some symptoms of burnout are chronic tiredness, irritability, accident-proneness, nagging cold symptoms, and a "who cares" attitude (16:12). Other possible results from stress are a disruption in sleeping and eating habits (quality, and well as quantity) and an increase in the consumption of alcohol, tobacco, caffeine, tranquilizers and other drugs (14:48). These activities, as a reaction to stress, are health practices that if one pursues may contribute to the already high levels of stress.

Alleviation of Fatigue. "What you do to cope with stress depends on how much of a problem you have. Remedies vary from changes in habits and lifestyle to formal behavior-modification programs" (18:185). If one knows the causes and effects of one's own fatigue then proper measures can be taken to help alleviate it. One of the first steps to take is to increase periods of rest and relaxation. Sufficient sleep is very important for improving resistance to stress. "Sleep is the great restorer of our energy pool. Without sleep, we soon cease to function properly" (2:150). Avoiding caffeine, drugs, and certain foods may help to prevent restless sleep. Taking leave from the job to relax is crucial. "For people in high stress jobs, taking leave tends to enhance decision-making and job performance capabilities" (23:20).

Exercise and certain hobbies can also be beneficial in reducing fatigue. Strenuous exercise activities which require full concentration activate different circuits of the brain and body than normally used during daily activities (10:84). Exercise dissipates pent-up energy and leads to physical fitness. If a person is physically fit, then he or she will be able to endure more without becoming

tired. Exercise also stimulates the body to generate more energy (2:113). Although exercise is a good way to lessen the fatigue level, one must be careful not to over-do the exercise, because too much exercise can over-stress the body. A hobby can also engage different circuits of the brain and can be an effective means of coping with stress (7:33).

A balanced diet may play a major role in helping to reduce stress. "Eating can either induce sleep or produce wakefulness, depending on which foods are eaten, by producing chemical changes in the brain" (2:95). Paying attention to the amount of protein, carbohydrates, fat, and various minerals consumed may help one to control the affects of food. It is also important to realize that an excess as well as a deficiency in vitamins may result in fatigue (2:94-103). Dehydration and water loss due to increased sweating during times of stress may also add to one's fatigue (18:7). "Adequate water consumption will benefit many areas of the body" (7:134). Peter Hanson in The Joy of Stress recommends an average of eight glasses of water a day.

Another very important way to alleviate fatigue is abstaining from the bad health practices of excessive alcohol and caffeine consumption, smoking, and drug usage. This is crucial because those practices will only add to one's fatigue. Excessive alcohol increases mental fatigue by decreasing glucose circulation to the brain and destroying irreplaceable brain cells. It may also interfere with sleeping. Smoking deteriorates the lungs and is partially responsible for many heart attacks and stomach ulcers. Drugs, such as tranquilizers, may help in the short-term but can become habit forming, causing a decrease in mental capacity in the long-term (7:61-68). Finally, too much caffeine is known to aggravate stomach ulcers, because under stress the stomach tends to shut down. Caffeine is also known to adversely affect the central nervous system (9:73).

The use of psychological stress management in the form of biofeedback, meditation, prayer, or counseling may also prove to be crucial in the ability to prevent or alleviate fatigue. For instance, biofeedback is said to be an efficient technique for the relief of stress. Basic to biofeedback is that the individual learns to work with and

control or normalize, at will, his own body physiology and emotional reactions. The patient has the ability to treat himself, by learning to heal himself through reducing his own muscle tension or lowering his own blood pressure (5). By regularly practicing one of the psychological stress management techniques mentioned above the individual can use the mind to control the body, resulting in most or all physiological activities being brought under voluntary control.

A final recommendation for reducing stress and preventing further fatigue is setting realistic goals, being prepared, and having a stable home environment. These three conditions should help to give one a sense of mastery and pleasure preventing further fatigue to develop (7:88-104).

Government Research on Fatigue

Most studies performed in the military on fatigue have been in the flying arena. From the early years of aviation, the flight environment has been known for its unique ability to cause fatigue. In fact, a 1963 survey suggested that three quarters of airline pilots experience fatigue (6:2). Justifiably, the primary reason aircrew fatigue is such an important concern is due to its impact on flight safety. How well a mission is performed can also be affected by

fatigue. These two reasons are what prompted a 1985 study to be performed by Douville titled "A Study of the Flight Environment Component of Aircrew Fatigue in Student Navigators". His study describes a proposal to be performed on T-43 navigator students to determine if fatigue could be assessed and compared for two different types of settings. One setting is an actual five hour T-43 flight and the second is a five hour ground simulator mission. Actual testing of blood chemistries would be performed along with a subjective fatigue questionnaire, the number of hours of sleep needed following the mission and the actual performance of the mission. Fatigue for the two settings would then be compared for statistical differences. This study was only described as a proposal to evaluate and understand fatigue in flight and no results were given.

Douville, along with others, identifies fatigue as either being physical or mental. He describes physical fatigue as having measurable parameters, such as having a decrease in strength, an increase in blood lactic acid, and a decrease in blood glucose. On the other hand, mental fatigue relies on subjective parameters including increases in irritability and anxiety, as well as a decrease in libido. He also disting-

uishes between acute fatigue, which can be alleviated by a period of rest and cumulative fatigue which carries over from day to day because of inadequate recovery.

Douville believes measuring the physiologic or biochemical parameters are useful because fatigue results from expenditure of physical and/or chemical energy by the body. If certain metabolic products could be strongly correlated with the degree of fatigue, then measuring them may help predict one's performance in the near future (6:1-14).

Bennett and Bondi developed an analysis in 1981 on the topic of the relationship between job performance to physical fitness and its application to U.S. Navy submariners. Bennett and Bondi believe that an implementation of an aerobic exercise regime would help maintain and improve physical fitness while lessening the stresses associated with the submarine mission. They say that the physical and psychological benefits of an exercise program would increase job performance because findings continue to support the fact that those individuals who are physically fit perform significantly better cognitively and show less symptoms of stress.

Whether the fatigue is physiological or psychological, Bennett and Bondi report that the end result is a reduction in

work efficiency and productivity. They also report that mental fatigue can be classified as: 1) boredom causing dissatisfaction with work, 2) tedium causing frequent interruptions, or 3) monotony causing an estimation of one's surroundings. Common symptoms of all three include tiredness and weariness. (3:1-8)

The authors of a third study, completed in 1981 by Widhalm and Burtchell, imply that environmental factors affect the crew of the P-3 Upgrade Aircraft by acting as stressors (25:134). They state that the environmental stressors act indirectly to increase crew fatigue and hence affect the successful completion of the mission. Their study continues to explain fatigue in order to show there is a relationship between environmental stressors, fatigue, and crew performance.

According to Widhalm and Burtchell, military aircrewmembers are quite familiar with skill fatigue, as it causes tiredness and haggard weariness resulting from long, vigilant, and diligent hours of labor in a stressful environment. They also say that the crew has recognized the deterioration in performance or efficiency associated with varying states of fatigue. Their research also acknowledges that when fatigue was taken to the laboratory to be studied,

decreases in work output became a synonym for fatigue.

Therefore, fatigue is manifested by a reduction in performance (25:135-136)

. Their literature suggests that mental fatigue was a direct result of low motivation, prolonged performance or a monotonous task, and lack of freedom of movement. Boredom and monotony also could be attributed to fatigue limiting the endurance of flying personnel (25:141). Furthermore, performance standards by the pilots deteriorated as fatigue increased because they did not realize their performance was suffering. Other findings were that "fatigue may result in irritability, gastric disturbance, insomnia, deterioration in reasoning or judgement. Sensory and motor hyperactivity, shortness of breath, and lowered morale" (25:143).

In a 1980 report by Savvov titled "How Do You Feel?", the author tells about an ongoing experiment by the Scientific Research Institute of Industrial Hygiene to investigate the symptoms of human fatigue during performance of work requiring extreme precision. Clinical studies show that work requiring stress causes a mass of functional shifts in the various organs and systems of the human organism to occur. Savvov's report quotes the supervisor of

the experiment, A.D.Liman, as saying "one of the problems on which we are now working is to devise an orderly system of indicators enabling us to judge the development of fatigue and different processes occurring in the human organism" (19:3). From the results of this experiment, the author hoped that in the future an electronic computer could register an individual's condition and provide a prognosis of fatigue growth so that the individual would be prepared to counteract the fatigue.

One last report to be noted is titled "Neurocognitive Pattern Analysis of Auditory and Visual Information". This 1986 interim report is based on experiments performed by the EEG (electroencephalography) Systems Laboratory which is responsible for improving the measurement of neuroelectric substrates of human higher brain functions. The lab's short-term objective is to use the EEG to predict decrements in performance resulting from attentional lapses or fatigue, while their long-term objective is to develop new technologies for enhancing cognitive abilities (8:1).

One of their experiments is on operational fatigue being recorded on four Air Force fighter test pilots. The fighter pilots performed various cognitive and perception

motor tasks specifically designed to require a high commitment of attention, memory, judgement and motor coordination. Results showed that persons in a fatigued condition may be able to perform rote behaviors, but often are unable to respond to sudden unexpected situations which require full commitment of higher cognitive functions. In addition, fatigue had a tendency to produce momentary lapses of attention, decision processes and perceptuomotor performance and there was also the reduced ability to perceive one's diminished capacity. This condition could promote serious or fatal consequences. The objective of this study was to gain more information in hopes that more effective methods of detecting this impaired condition could be developed before it affects actual performance (8:16).

Summary

This chapter presented a review of the literature by first providing a detailed discussion of what fatigue is and how to alleviate it. Government related research on this topic was then presented. Since the literature has shown a direct relationship between fatigue and performance, the remainder of this research will focus on the issue of health practices and its relationship to fatigue. A desired

outcome of this research effort is to determine if by following certain health practices one can control the amount of fatigue being experienced, thus, improving work performance and efficiency. The next chapter will provide the methodology employed to test the research hypothesis and answer the investigative questions.

III. Methodology

Overview

This chapter describes the methodology used to collect and analyze the data needed for testing the research hypothesis and answering the investigative questions outlined in Chapter I. First, the instrument used to collect the data for this study will be presented along with a discussion of the structure of the survey. Then, the target population and the related sample will be identified. Next, the statistical tests used to perform the data analysis will be addressed followed by some assumptions and limitations related to this study.

Data Collection Instrument

Because the type of data analysis to be performed in this type of study necessitates a large sample size, a mail survey was selected. This method will be able to encompass the large sample with the most ease and least cost than any alternative method such as personal or telephone interviews (22:289-290). With the mail survey, respondents can take more time and respond more freely and conveniently. It is hoped that the anonymous nature the mail survey emphasizes

will provide accurate and reliable results. The use of direct questions with simple responses will make the survey easy to respond to and also easier to analyze with the use of a computer. The data collected will be coded, transferred to optical scan sheets, and read into a data file.

The original questionnaire was pretested for content validity on 30 graduate students enrolled in the graduate program of the School of Systems and Logistics (LS), Air Force Institute of Technology (AFIT), Wright-Patterson AFB, Ohio. This pretest group was selected because graduate students normally are under a great deal of stress and fatigue and should be able to relate to the questions. Changes were made, as needed, based on suggestions by the pretest group. For further validity, the questionnaire stated that individual responses would be combined with others and not attributed personally in any way.

Survey Structure

Although there have been various questionnaires developed and distributed to gather information on health practices, no existing questionnaire could be located to collect the data for this particular study (4; 20; 24). The

survey for this study needed questions on fatigue as well as health practices in order to test the research hypothesis and answer the investigative questions. Therefore, the majority of questions in the survey were taken from questionnaires used by three previous graduate students who did research in the area of health practices (1; 11; 21). Other questions were taken from a study performed by the office of the Assistant Secretary for Health (20) and from the Holmes-Rahe Scale of Stress Ratings (10:45-51). The remaining questions, the majority relating to the fatigue portion of the survey, were developed by myself with the assistance of Dr William Mauer and Major Kenneth Jennings, LS Faculty members. A copy of the survey questionnaire used for this research is located in Appendix A.

The survey includes 48 multiple choice questions and two short answer questions. The questions are grouped into the following four parts. The first part contains seven questions on background and demographic information to develop a profile of those who respond. The second section has 24 health-type questions that are related to the seven health practices of alcohol and caffeine consumption, exercise, eating, sleeping, and smoking habits, and

psychological stress management. The third part of the survey is included to help determine the amount of stress the respondent may be under based on several life events that may have occurred within 24 months prior to taking the survey. The fourth and final section, of 13 questions, attempts to measure the amount of fatigue the respondent is experiencing. Also in this section are the two short answer questions used to determine the amount of awareness the individual has of experiencing fatigue and the related effects of one's fatigue.

The data provided by the respondents consists of nominal and ordinal level data. However, some of the ordinal level data will be from a five-point Likert Scale and will be treated as interval level data for statistical analysis.

Population and Sampling

The target population consists of all military officers in rank major to colonel and civilian personnel in grade GS/GM 13-15 assigned to and physically located at Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. The size of the population was estimated using the ATLAS data base. Since separate analysis and comparisons were performed on civilian versus military

personnel, the target population was kept segregated in their respective groups. Based on the information in the book Foundations of Behavioral Research (13) and on the advice of Major Jennings a simple, random sample size of 250 was selected for both the military group and civilian group. The main reason for this sample design is that correlation analyses are to be performed on the data and there are many (50) survey questions. At least five people per question should be surveyed so that accurate analysis can be conducted.

The number of surveys actually distributed was based on an estimated response rate of 55%. Since the desired number of returned surveys was 250 for each subgroup a total of 450 surveys were mailed out to both the military and civilian groups. The individual names and organizations were provided by the ATLAS data base and were based on the last digit of the individual's social security number in order to keep the sample random and unbiased. In hopes of increasing the response rate, an offer to supply results to the respondents was included with the survey package.

Statistical Tests

Once read to the computer data file, the data from the surveys was analyzed using the computer support equipment provided by the Air Force Institute of Technology. The program used was the Statistical Package for the Social Sciences (SPSS-X). Several statistical techniques were used to analyze the data. Initially, frequencies were tabulated to help develop a demographic profile of the respondents, as well as the response rate for each rank and grade.

In addition, in order to help determine whether the null hypothesis stated in Chapter I should be rejected or not, the following SPSS-X subprograms were used to analyze the investigative questions: PEARSON CORR, FACTOR, RELIABILITY, ANOVA, NPAR TESTS K-S, CROSSTABS, and FREQUENCIES. Further explanation of these subprograms and the actual statistical test they apply will be provided, along with test results in Chapter IV.

Assumptions and Limitations

Assumptions. A few of the assumptions made in order to proceed with this research study are identified at this time. First of all, the assumption is made that all respondents are able to accurately answer the survey questions. Sometimes it is difficult to perform a self-analysis on the types of ques-

tions involved in this study. The second assumption is that the health practices used in this study are indeed related to fatigue, an assumption based upon the literature presented in Chapter II. Finally, the assumption needs to be made that the data was correctly coded by the respondents and then properly transferred into the data file.

Limitations. One major limitation associated with this research is that the results only apply to the target population and can not be applied to the Air Force or any other organizations. The other limitation is the concept identified above about self-analysis. It can be very difficult to report on oneself. For example, the respondents preception of one's self may not be how others perceive what is the truth.

Summary

This chapter specified the methodology used for this study. The next chapter presents and analyzes the results obtained from the data.

IV. Results and Analysis

Overview

The purpose of this chapter is to present the results of the survey data analysis. First, the overall survey response will be summarized. Then, a demographic profile from selected questionnaire items will be presented. Finally, using the statistical techniques outlined in Chapter III, the investigative questions will be analyzed and discussed individually.

Survey Response

Table 4.1 displays the response rate for each military rank and civilian grade included in the target population. Both of the respondents who fell into the 'other' category were excluded from the demographic profile and data analysis since they were not part of the target population.

Combining the three military ranks shows 450 surveys mailed out and 318 surveys returned, for an overall military response rate of 70.7 percent. The response rate for the combined civilian grades was much lower; only 51.1 percent since 230 surveys were returned from the 450 mailed out. The overall response rate for the combined military and civilian

groups was 61.1 percent which is higher than the estimated response rate of 55 percent discussed in the methodology chapter.

TABLE 4.1
Survey Response by Military Rank and Civilian Grade

Rank/Grade	Number of Responses	Number in Sample	Response Rate (%)
Major	161	245	65.7
Lt Colonel	116	148	78.4
Colonel	41	57	71.9
GS/GM-13	114	248	50.0
GS/GM-14	67	122	54.9
GS/GM-15	49	80	61.3
Other *	2	0	-
TOTAL	550	900	61.1

* The category 'other' included a captain and a GS-12.

Demographic Profile

The following six tables display demographic characteristics of the respondents to this study. The bottom line totals exclude the two respondents that were in the 'other' category.

Respondents' Rank/Grade. Table 4.2 shows that the military respondents (58.1%) outnumbered the civilian respondents (41.9%) in the sample. Majors (29.4%) and GS/GM-13's (20.8%) make up just over half of the respondents (50.4%), while Colonels (7.5%) and GS/GM-15's (8.9%) comprise only a small portion (16.4%) of the sample.

TABLE 4.2

Respondents' Rank / Grade

Category	Count	Frequency	
		Percentage	Cumulative
Major	161	29.4	29.4
Lt Colonel	116	21.2	50.6
Colonel	41	7.5	58.1
GS/GM-13	114	20.8	78.9
GS/GM-14	67	12.2	91.1
GS/GM-15	49	8.9	100.0
Total	448	100.0	

Respondents' Sex. Table 4.3 indicates that very few (3.8%) of the respondents were female. This is basically because of the small number of women in the designated target population.

TABLE 4.3

Respondents' Sex

Category	Frequency	
	Count	Percentage
Male	527	96.2
Female	21	3.8
Total	548	100.0

Respondents' Age. Table 4.4 displays the frequencies of the ages of all the respondents. The table shows that the majority of the respondents (59.9%) are between 36 to 45 years of age. Only 3.1 percent are either younger than 31 or older than age 60.

Table 4.4
Respondents' Age

Category	Frequency		
	Count	Percentage	Cumulative
30 or younger	8	1.5	1.5
31 - 35 years old	57	10.4	11.9
36 - 40 years old	164	29.9	41.8
41 - 45 years old	162	29.6	71.4
46 - 50 years old	72	13.1	84.5
51 - 55 years old	47	8.6	93.1
56 - 60 years old	29	5.3	98.4
61 years or older	9	1.6	100.0
Total	548	100.0	

Respondents' Job Type. Respondents were asked to indicate in what area of work their current job is most associated. Table 4.5 displays the job categories and respective frequencies.

TABLE 4.5
Respondents' Job Type

Category	Frequency	
	Count	Percentage
Program Management	205	37.4
Configuration / Data Management	7	1.3
Test / Evaluation	40	7.3
Engineering	137	24.9
Manufacturing Production	19	3.5
Logistics	12	2.2
Program Control	20	3.7
Operations / Support	21	3.8
Integration	6	1.1
Other	81	14.8
Total	548	100.0

Program Management had the greatest number (37.4%) followed by Engineering (24.9%). These two categories together constituted 62.3 percent of the respondents.

Respondents' Experience. Table 4.6 shows the number of years the respondents have worked in their current area of work. The over 10 years of experience category was by far the largest with 42.1 percent. Respondents with 10 years of experience or less comprise 57.9 percent of the sample returns.

TABLE 4.6
Respondents' Experience

Category	Frequency		
	Count	Percentage	Cumulative
Less than 1 year	63	11.4	11.4
1 - 2 years	77	14.0	25.4
3 - 4 years	74	13.6	39.0
5 - 6 years	46	8.4	47.4
7 - 8 years	37	6.8	54.2
9 - 10 years	20	3.7	57.9
over 20 years	231	42.1	100.0
Total	548	100.0	

Respondents' Subordinates. The last demographic related question in the survey asked respondents to indicate how many people worked directly under them. Table 4.7 shows almost half of the respondents (48.7%) have five or less people working for them, while 15 percent of the respondents have over 30 people working for them.

TABLE 4.7

Respondents' Subordinates

Category	Frequency		Cumulative
	Count	Percentage	
0 - 5 people	267	48.7	48.7
6 - 10 people	98	18.0	66.7
11 - 15 people	36	6.6	73.3
16 - 20 people	32	5.8	79.1
21 - 25 people	20	3.6	82.7
26 - 30 people	15	2.7	85.4
31 - 35 people	11	2.0	87.4
36 - 40 people	10	1.8	89.2
over 40 people	59	10.8	100.0
Total	548	100.0	

Test Procedure

For each of the tests employed through out the remainder of this chapter, a level of significance, called alpha, will be specified. This alpha value is the test statistic used to determine whether statistically significant information is available to reject claims about the data. Alpha is also the probability of rejecting the claim when it is actually true, called a Type I error. For example, using an alpha value of .05 as the test statistic means that there is a probability of rejecting a claim, when it is true, less than or equal to five percent.

For each statistical technique used, the claim will be stated along with a specified significance level. Therefore, when the computed probability value (P-value) for each test is given, it will be compared to the designated test statistic, alpha, to determine if the claim should be rejected or not. P-values less than or equal to alpha means the claim should be rejected because the data does not support the proposed claim. Data is classified as statistically significant if the claim is rejected and not significant otherwise.

Analysis of Investigative Questions

Before analyzing each investigative question individually, three statistical tests were applied to the fatigue related data. First, Pearson correlation and factor analyses were performed on the data to simplify the remaining analyses by grouping certain variables. Then a reliability test was accomplished to demonstrate the reliability and stability of the data.

Pearson Correlation and Factor Analysis. The first test applied to the data was a Pearson correlation analysis of the variables defined for the fatigue portion of the survey. There were nine questions in Part IV of the survey (#36, 41, 42-48), see Appendix A, that were used to help identify fatigue levels of respondents. These nine variables were tested using the SPSS-X subprogram PEARSON CORR to determine if direct relationships existed among each pair of variables. The claim to be tested is that there will not be significant relationships between variables. Table 4.8 displays the matrix of coefficients. All variables are statistically significant at the .01 significance level except for one variable. That is, the initial claim that variables are not significantly related is rejected for all variables except one. The variable for the

TABLE 4.8

Pearson Correlation Coefficients Matrix
of Fatigue Variables

Variables	1	2	3	4	5	6	7	8	9
Compare Energy Level to Others	1.0000								
Rate Typical Day *	.3459	1.0000							
How Often Worrying *	.2703	.3992	1.0000						
How Often Enjoy Free Time	.2825	.2705	.3505	1.0000					
How Often Have Free Time	-.0582	.0960**	.0424	-.0578	1.0000				
How Often Happy *	.3007	.3362	.3899	.5139	-.0591	1.0000			
How Often Irritable/ Provoked *	.1657	.2840	.4230	.3201	.0067	.4241	1.0000		
How Often Exhausted *	.4141	.2784	.3090	.2848	-.0333	.2894	.3133	1.0000	
How Often Fatigue Gets in Way of Work *	.3121	.1929	.2553	.2113	-.0146	.2647	.2595	.5215	1.0000

* All values have .000 Level of Significance

** .05 Level of Significance

question on "How often have free time" was not found to correlate with any of the other variables and was removed from the group of variables used to determine fatigue levels. The remaining eight variables are very highly correlated with P-values much less than the .01 alpha value.

Once the eight variables were determined to be correlated, the SPSS-X subprogram FACTOR, for factor analysis, was used to help reduce the set of variables into groups, making it simpler to perform additional data analysis. Basically, factor analysis removes duplicated information from among a set of variables by grouping similar variables into a smaller set of derived variables called factors. This is a data reduction technique used to remove the redundancy from a set of correlated variables (12:378).

Initially, each of the eight variables were designated as factors so that a principal-components (PC) factor analysis could be performed extracting each factor one at a time. This is done to determine how much each factor, when extracted, accounts for the total variance of the data. Once the PC analysis was accomplished, only two factors were extracted because 54.2 percent of the variance of the data was accounted for.

Next, the computer program conducted a process called "varimax rotation". This process redistributes the explained variance among the two extracted factors, producing sharper distinctions in the meanings of the factors (12:389-390). In simpler terms, each variable is correlated with the appropriate factor as much as possible while redistributing the explained variance. This process yields "factor loadings", which aid in the assignment of variables to factors. These factor loadings are displayed in Table 4.9.

Finally, each variable was assigned to a factor based on the factor loadings. It is at this point that the two factors were given descriptive names. After analyzing each variable and how they loaded onto the factors, the researcher determined that Factor 1 best represented psychological fatigue while Factor 2 seemed to represent physiological fatigue.

The primary reason for these factor names is based upon the knowledge gained in the Literature Review in Chapter II. In that chapter, the research indicated there was a distinction between psychological or mental fatigue and physiological or physical fatigue. The factor loadings appeared to differentiate mental dimensions from physical dimensions. The only variable in question was the 'rate typical day' variable, as

shown by it having a loading for both factors. After some thought and analysis of the survey question, this variable was grouped with the physiological fatigue factor.

TABLE 4.9

Factor Loadings
from the Varimax Rotation
(for values > .3)

Variable Name	Factor 1	Factor 2
How often happy	.77109	
How often enjoy free time	.70143	
How often irritable	.69137	
How often worrying	.68790	
Rate typical day	.52231	.31509
How often exhausted		.81631
How often fatigue gets in way of work		.78559
Compare energy level to others		.65415

Reliability. Now that the fatigue variables have been grouped into two factors a reliability test was deemed necessary to determine the reliability of the fatigue measurements being used. This reliability was checked using the SPSS-X subprogram RELIABILITY. The variables for the two factors, psychological fatigue and physiological fatigue, were kept segregated and then run through the reliability check to make sure the data for each factor made sense. The computer program calculated a measure called a "Cronbach Alpha". This measure was used as a standard. Variables were deleted individually and a new Cronbach Alpha was calculated and compared to the standard. The reliability test on the variables associated with the psychological fatigue factor indicated a Cronbach alpha of .7302 and for the variables associated with the physiological fatigue factor, a Cronbach alpha of .6745 resulted. An inspection of the alpha values when a variable was deleted from their respective groups indicated that the alpha values would only decrease and in no situation did the alpha value increase if a variable was deleted. This was also true for the variable in question under the factor loading portion discussed earlier. In other words, adding the variable 'rate typical day' to the physiological

fatigue factor increased the reliability and did not drive the alpha value down. In summary, the variables 'how often happy, how often enjoy free time, how often irritable, and how often worrying that fall within the psychological factor appear to be reliable, with consistent data, as do the variables 'rate typical day, how often exhausted, how often fatigue gets in way of work, and compare energy level to others' that fall within the physiological factor.

In conclusion, before an analysis could be made on the individual investigative questions several statistical tests were applied to the data provided by Part IV of the survey questionnaire. These tests showed that not only were the fatigue variables highly correlated to each other, but they also split out very nicely into the two types of fatigue factors discussed in the Literature Review.

These two factors, psychological fatigue and physiological fatigue appear to have very reliable and consistent variables making up the overall measurement of the fatigue levels. Using these two fatigue factors will make further analysis of the investigative questions much simpler to perform.

Investigative Question One. Are the following health practices related to the amount of fatigue being experienced?

- a) alcohol consumption
- b) caffeine consumption
- c) amount of exercise
- d) eating habits
- e) sleeping habits
- f) smoking habits
- g) psychological stress management

This first question will be analyzed using the health practice survey questions included in Part II of the questionnaire. Each question will be compared individually to see if it is related to either fatigue factor. More specifically, each health question will be compared to psychological fatigue and then to physiological fatigue using the SPSS-X subprogram PEARSON CORR to determine which health practice when related to fatigue are statistically significant. The initial claim is that there will not be a significant relationship. For P-values less than .05, it is determined there is a significant relationship, thus rejecting the initial claim.

By using correlation coefficients associated with correlation analysis, measures of the degree of association between two variables can be determined. Although the existence of a high correlation between two variables does not necessarily imply causality, it does indicate there is a relationship

(12:213-216). One way to determine causality is to experiment with the seven health practices by bringing them under control and observing the impact they may have on fatigue.

Alcohol Consumption. Survey questions 8 and 9 are related to alcohol consumption. The first question is related to the frequency of alcohol consumption, while the second question asked the amount of consumption per each occasion. When considering their relationship to the two fatigue factors, it appears that the frequency of alcohol is correlated more with the physiological fatigue but the quantity of consumption is more directly related to psychological fatigue. Table 4.10 displays the correlation coefficients for these two variables. While two of the four correlation coefficients are small in magnitude, they are statistically significant.

TABLE 4.10

Correlation Coefficients
for Alcohol Consumption (n=548)

Variables	Psychological Fatigue	Physiological Fatigue
Frequency of Alcohol Consumption	-.0047	-.1364 **
Quantity of Consumption	.0818 *	-.0260

* P-value < .05 Level of Significance

** P-value < .01 Level of Significance

Caffeine Consumption. Questions 10 and 11 pertain to caffeine consumption. Again, the first question asked the frequency of consumption while the second one questioned the amount of caffeine consumed per each occasion. In this examination, both the frequency and the quantity of consumption correlated only with the psychological fatigue factor and did not appear to correlate with physiological fatigue at any critical level of significance. Table 4.11 displays the results of the correlation coefficients. Again, the degree of association is very small.

TABLE 4.11

Correlation Coefficients
for Caffeine Consumption (n=548)

Variables	Psychological Fatigue	Physiological Fatigue
Frequency of Caffeine Consumption	.1043 *	.0351
Quantity of Caffeine Consumption	.1365 *	.0540

* P-value < .01 Level of Significance

Amount of Exercise. Questions 12 - 14 are related to the health practice of exercise. Question 12 asked respondents to indicate the amount of strenuous physical activity they participate in, question 13 asked how much exercise they participate in not requiring strenuous physical activity, while the last question in this category inquired into the amount of relaxation being done with some form of mind activity. Strenuous exercise was moderately correlated with physiological fatigue; however, non-strenuous physical activity did not correlate with either fatigue factor. Then, not suprisingly, relaxing with some form of mind activity had relatively high

correlation with both psychological fatigue and physiological fatigue. The results for this correlation analysis appear in Table 4.12.

TABLE 4.12
Correlation Coefficients
for Amount of Exercise (n=548)

Variable	Psychological Fatigue	Physiological Fatigue
Strenuous Physical Activity	.0429	
Non-Strenuous Physical Activity	.0667	.0435
Relax with Mind Activities	.2466 *	.1465 *

* P-value < .01 Level of Significance

Eating Habits. This health practice had nine questions. The relatively large number were required to inquire into the respondents eating habits. Questions 16 - 25 are related in some way to eating habits or dietary concerns. The first question is related to calorie consciousness and respondents were asked to indicate how closely they tracked calories. This health habit was not related to either fatigue

factor. The next four questions asked how much respondents controlled the amount of fat, protein, carbohydrates, and fiber they consumed. Of the four, the only one that appeared to have any direct relationship to either fatigue factor was the one on fat intake. Fat intake was significantly correlated with the physiological fatigue factor.

Question 21 asked respondents to indicate results of having their blood tested for cholesterol. However, the question was not worded in such a way as to provide accurate analysis of the relationship of cholesterol problems with fatigue.

The next question inquired into the number of times respondents ate breakfast each week and it did not appear to have a relationship with either fatigue factor; however, the following question pertaining to the number of glasses of water consumed each day did appear to have a positive relationship with the psychological fatigue factor. Question 24 was related to vitamin intake and it did not appear to have a relationship with either fatigue factor. Finally, the question asking respondents to compare their present weight with what they would like to weigh had a direct relationship to both the psychological and physiological fatigue factors. The results

of all the correlation coefficients for the variables on eating habits are found in Table 4.13.

TABLE 4.13
Correlation Coefficients
for Eating Habits (n=548)

Variable	Psychological Fatigue	Physiological Fatigue
Calorie Conscious	-.0628	.0158
Control Fat	.0439	.1060 **
Control Protein	.0385	.0253
Control Carbohydrates	.0187	.0526
Control Fiber	.0304	.0315
Eating Breakfast	-.0169	.0248
Drinking Water	.0886 *	.0448
Taking Vitamins	-.0178	-.0258
Compare Weight	-.0857 *	-.1609

* P-value < .05 Level of Significance

** P-value < .01 Level of Significance

Sleeping Habits. Questions 26 - 28 are related to sleeping habits. Respondents were asked to indicate the average number of hours they sleep each night, and then how often they are affected by insomnia. Finally, they were asked to answer how often they get less than their desired amount of sleep. All three of these questions seemed to have a relationship with fatigue. The first question, on the amount of sleep each night, was only related to psychological fatigue, whereas the questions on insomnia and desired amount of sleep were relatively highly correlated with both fatigue factors. The results are displayed in Table 4.14.

TABLE 4.14

Correlation Coefficients
for Sleeping Habits (n=548)

Variable	Psychological Fatigue	Physiological Fatigue
Quantity of Sleep	.1048 *	.0292
Affected by Insomnia	.2797 *	.2316 *
Actual vs Desired Sleep	.2940 *	.3755 *

* P-value < .01 Level of Significance

Smoking Habits. There was one question (#29) which inquired into the smoking habits of respondents. Respondents were asked to indicate how much they smoked each day. There did not appear to be any relationship with this variable and either fatigue factor. The P-value was greater than .05.

Psychological Stress Management (PSM). The final question was related to the seventh and final health practice to be analyzed by this study. Respondents were asked to indicate how often they practiced any form of psychological stress management. Results indicated that there was not a strong enough relationship between PSM and fatigue to be statistically significant. Again, the P-value was greater than .05.

Investigative Question Two. How does the fatigue level of military personnel compare to that of civilian personnel?

Again, fatigue was kept separate for the psychological and physiological dimensions. The SPSS-X subprogram ANOVA, for analysis of variance, was used to test for statistically significant differences in fatigue levels of military compared to civilian personnel. Basically, analysis of variance is used for identifying and measuring the various sources of variation within a collection of data. This analysis is performed to determine whether the sample statistics differ more than expected by pure chance. For this analysis the F Distribution

is used. The F statistic used, is the ratio of the military sample variance to the civilian sample variance adjusted for degrees of freedom. This ratio should indicate to what degree the two sample means differ.

The claim to be tested is that there will not be any difference in the fatigue levels of the two groups. A significance level of .05 was used. The results of the analysis of variance tests are provided in Table 4.15.

In summary, the ANOVA test indicated that there are not statistically significant differences between the military and civilian personnel in either the psychological dimension of fatigue or the physiological dimension. As shown in Table 4.15, both p-values (.585 and .239 respectively) are well above the designated significance level of .05.

TABLE 4.15

Analysis of Variance
for
Military and Civilian Differences
in Fatigue Levels

Fatigue Dimension	F	P-value
Psychological Fatigue	.647	.585
Physiological Fatigue	1.411	.239

Investigative Question Three. What are the major differences in the health practices followed by military personnel as compared to that of civilian personnel?

In answering this question, the health practices already presented and discussed for investigative Question One will again be used. For example, both questions related to the health practice of alcohol consumption will be analyzed to determine if there is a statistically significant difference between military personnel and civilian personnel in terms of frequency or quantity of alcohol consumption.

The three different ranks of the military were combined to form the military sample group, while the three civilian grades

were combined to form the sample civilian group. These two groups were then tested for statistically significant differences in their health practices using the SPSS-X subprogram NPAR TESTS K-S. This is a nonparametric test called Kolmogorov-Smirnov (K-S) that is used when comparing the frequency distributions of two independent random samples and when the data to be analyzed is at least ordinal. Since the military and civilian groups are both independent random samples, as explained previously in the Population and Sampling section of the Methodology Chapter, and the data collected on health practices was measured on an ordinal scale, it is appropriate to apply the K-S test on the data.

Basically, the K-S two-sample test is a test of the homogeneity of the underlying distributions. It is sensitive to any difference between the two distributions. A significance level of .05 was used to help determine if there were any significant differences between the distributions of the military and civilian groups. The claim to be tested is that there will not be any difference in distributions. The results of this test, for each health practice and its respective significance, are displayed in Table 4.16.

TABLE 4.16

Summary of K-S 2-Sample Test
(Military & Civilian)
for Each Health Practice

Health Practice	P-value
Frequency of Alcohol Consumption	.286
Quantity of Alcohol Consumption	.910
Frequency of Caffeine Consumption	.362
Quantity of Caffeine Consumption	.160
Strenuous Physical Activity	.000 *
Non Strenuous Physical Activity	.178
Relax with Mind Activities	.255
Calorie Conscious	.863
Control Fat	1.000
Control Protein	.969
Control Carbohydrates	.993
Control Fiber	1.000

* P-value < .01 Level of Significance

Table 4.16 (cont)

Health Practice	P-value
Eating Breakfast	.218
Drinking Water	.879
Taking Vitamins	.971
Compare Weight	.152
Quantity of Sleep	.343
Affected by Insomnia	.466
Actual vs Desired Sleep	1.000
Frequency of Smoking	.053
Frequency of PSM	1.000

In summary, the Kolmogorov-Smirnov test indicated that in all but one health practice there were no statistically significant differences between the military and civilian personnel. The P-value for all but one are greater than .05. The one health practice that did show a significant difference is the one related to strenuous physical activity.

The SPSS-X subprogram CROSSTABS was then applied to the data for this health practice to provide frequencies of how the two groups responded to this question. The resulting frequencies are shown in Table 4.17. It appears that the military group participates in strenuous physical exercise much more frequently than the civilian members. For example, 49.4 percent of the military group participates in strenuous exercise at least three times a week, whereas only 32.3 percent of the civilians participate at that same frequency. On the other hand, 39.5 percent of the civilians indicated participating in strenuous exercise less than once a month, with 17.8 percent of the sample responding they never exercised. The comparative percentages for the military respondents are 17.9 percent that exercise less than once a month and 4.1 percent indicating they never exercise.

TABLE 4.17

Crosstabulation of Strenuous Physical
Exercise by Military and Civilian Groups

Category	<u>Military</u>		<u>Civilian</u>	
	Count	Percentage	Count	Percentage
Almost every day	53	16.7	19	8.3
About 3-5 times/week	104	32.7	55	23.9
About 1-2 times/week	68	21.4	32	13.9
About 1-3 times/month	36	11.3	33	14.3
Less than once a month	44	13.8	50	21.7
Never	13	4.1	41	17.8
Total	318	100.0	230	100.0

The only other health practice which was close to being statistically significant at alpha equal to .05 is the one indicating the frequency of smoking ($\alpha = .053$). The major differences in the response to this question are that more civilians (6.1%) smoke or chew tobacco at least one pack or can a day than the military (3.8%) and more military (63.8%) reported never smoking or chewing than the civilians (52.2%).

Investigative Question Four. What are some of the health practices followed by those reporting minimum amounts of fatigue?

As before, fatigue will be analyzed from the two different dimensions of psychological and physiological fatigue. The subprogram BARCHART under FREQUENCIES was used to display the graphical representation of both fatigue factors. For example, each fatigue factor has four variables which make up its measurement. Each variable was scaled from one to five, so when the overall level of each fatigue factor was computed, the four variables were added together and then divided by four. The barchart displays the frequencies of these computed fatigue levels. Tables 4.18 and 4.19 present the frequencies of the fatigue levels of all respondents for both fatigue factors.

TABLE 4.18

Respondents' Psychological Fatigue Level

Psychological Fatigue Level	Frequency		
	Count	Percentage	Cumulative
1.50	8	1.5	1.5
1.75	17	3.1	4.6
2.00	61	11.1	15.7
2.25	92	16.8	32.5
2.50	103	18.8	51.3
2.75	84	15.4	66.7
3.00	66	12.0	78.7
3.25	46	8.4	87.1
3.50	36	6.6	93.7
3.75	21	3.8	97.5
4.00	10	1.8	99.3
4.25	3	.5	99.8
4.50	1	.2	100.0
Total	548	100.0	

TABLE 4.19

Respondents' Physiological Fatigue Level

Physiological Fatigue Level	Frequency		
	Count	Percentage	Cumulative
1.00	2	.4	.4
1.25	6	1.1	1.5
1.50	18	3.3	4.8
1.75	36	6.6	11.4
2.00	69	12.6	24.0
2.25	93	17.0	41.0
2.50	96	17.5	58.5
2.75	79	14.4	72.9
3.00	62	11.3	84.2
3.25	44	8.0	92.2
3.50	17	3.1	95.3
3.75	16	2.9	98.2
4.00	9	1.6	99.8
4.25	1	.2	100.0
Total	548	100.0	

Once the frequencies of the respondents' fatigue levels were known, two groups were formed and named for each type. One group consisted of those with psychological fatigue values less 2.0 and one group with values greater than 3.5. The first was labeled 'low' and the other 'high'. On the other hand, values less than 1.75 were grouped as 'low' and greater than 3.25 as 'high' for the physiological fatigue factor. This separation into groups was done so a comparison could be made between health practices followed by those having low levels of fatigue with those having high levels of fatigue.

The two new groups, for each fatigue factor, were then tested for statistically significant differences in health practices using the previously discussed program NPAR TESTS K-S. To allow for larger p-values, this time a significance level of .10 was used to test which health practices appeared to have significant differences in distribution for the two groups of low fatigue and high fatigue. The initial claim is that there will not be any differences in the two groups. First, significant findings, which caused rejection of this claim, meaning there are significant differences, will be presented on psychological fatigue in Table 4.20, followed by physiological fatigue in Table 4.21.

Table 4.20

Summary fo K-S 2-Sample Test
(Low and High Psychological Fatigue)
for each Health Peactice

Health Practice	P-value
Quantity of Alcohol Consumption	.038 *
Frequency of Caffeine Consumption	.025 *
Quantity of Caffeine Consumption	.017 *
Relax with Mind Activities	.000 **
Affected by Insomnia	.000 **
Actual vs Desired Sleep	0. **

* P-value < .05 Level of Significance

** P-value < .01 Level of Significance

Psychological Fatigue and Health Practices. Table 4.20 displays the results of those health practices having statistically significant differences in distribution of frequencies for respondents' having low psychological fatigue as compared to those with high fatigue. Again, the claim is that there are no differences. Using the Kolomogorov-

Smirnov (K-S) test at alpha equal to .10, the health practices of quantity of alcohol consumption, frequency and quantity of caffeine consumption, relaxing with mind activities, affected by insomnia, and actual versus desired sleep all appear to have significant difference (P-values < .10) between those reporting minimum psychological fatigue to those with high amounts. The SPSS-X subprogram CROSSTABS was then applied to provide the frequencies of the responses for each group. The results of the frequencies for each health practice having significant differences are shown in Appendix B.

Basically, for the health practice of quantity of alcohol consumption, Table B.1 shows respondents reporting having no drinks at all or only one drink reported low fatigue (46.5%). Conversely, those with high fatigue reported consuming two or more drinks (76%).

Additionally, almost half (49.3%) of those designated with high fatigue report drinking caffeine more than twice a day (Table B.2), when compared to 25.6 percent of the respondents associated with low fatigue. As shown in Table B.3, the quantity of caffeine consumed is less than two cups or cans for 80.2 percent of the low fatigue group while the high fatigue group reporting only 59.2 percent for the same consumption. In

fact, the high fatigue group has 16.8 percent indicating 5 or more drinks while only 5.9 percent of the minimum fatigue group reporting that way.

As indicated in Table B.4, a major difference appears in the responses of the two groups on the health practice of relaxing with mind activities. 75.6 percent of the respondents in the low fatigue group report relaxing with a mind activity at least three times a week while only 39.5 percent of the high fatigue group reported doing the same. Furthermore, as few as 4.7 percent of the low group reported 'less than once a month or never' while almost four times as many (18.3%) of the high group responded this way.

The next major distinction is shown in Table B.5. That is, 73.2 percent of the low fatigue group reported 'never or only once every four months' being affected by insomnia while only 38.0 percent of the high group indicating these two responses. Even more interesting is the fact that 21.2 percent of the high group is affected by insomnia at least once a week compared to only 3.5 percent of the low group.

In answering the question on how often they got less than their desired amount of sleep, 84.9 percent of those with low fatigue reported "usually or always getting enough

sleep", while 63.3 percent of those with high fatigue reported "too often not or never getting enough sleep" (Table B.6).

TABLE 4.21

Summary of K-S 2-Sample Test
(Low and High Physiological Fatigue)
for each Health Practice

Health Practice	P-value
Strenuous Physical Activity	.077
Relax with Mind Activities	.086
Compare Weight	.082
Affected by Insomnia	.000 *
Actual vs Desired Sleep	0. *

* P-value < .01 Level of Significance

Physiological Fatigue and Health Practices. Table 4.21 displays the results of those health practices having statistically significant differences (P-values < .10) in distribution of frequencies for respondents having minimum physiological fatigue as compared to those with high fatigue. Using the same K-S test, the health practices of strenuous physical activity, relaxing with mind activities, compare weight, affected by insomnia, and actual versus desired sleep each

appeared to have significant differences between the low and high fatigue groups. Frequencies of these two groups were computed using CROSSTABS and are located in Appendix C.

Results in Table C.1 showed half (50.0%) of the respondents' in the low fatigue group participate in strenuous physical activity at least three times a week while only 31.0 percent of the high fatigue group participate at this frequency. In fact, 41.3 percent of the high fatigue group versus 29.0 percent of the low group strenuously exercise less than once a month.

Further, 72.6 percent of the low fatigue group report relaxing with a mind activity at least three times a week as compared to just over half (51.7%) of the high group doing the same (Table C.2). Additionally, only 4.8 percent of the low group reported relaxing less than once a month or never, while over three times as many (14.9%) of the high group responded this way.

Next, as Table C.3 indicates, a very high percentage (75.9%) of the high fatigue group indicated being slightly over or very overweight when comparing their present weight to what they would like to weigh. Over twenty percent less of the low fatigue group also responded this way (54.9%).

Similarly to the results for psychological fatigue, there was a major distinction between the two groups in their response to how often affected by insomnia. Table C.4 shows 72.5 percent of the low fatigue group reported 'never or only once every four months' being affected, which is almost twice as much as the high fatigue group at 34.5 percent. In addition, 21.8 percent of the high group is affected by insomnia at least once a week when compared to only 4.8 percent of the low group.

Finally, when comparing how often respondents get less than their desired amount of sleep, Table C.5 indicates the high fatigue group had a large percentage (89.6%) indicate 'too often not or never getting enough sleep' while the low group had only 12.9 percent respond this way. In fact, 87.1 percent said they 'usually or always get enough sleep' from the low group.

In summary, for both fatigue factors, those reporting low amounts of fatigue as compared to those with high amounts appear to be consuming less alcohol and caffeine, participating more often in strenuous physical activities, as well as relaxing with some form of mind activity. Low fatigued individuals are also more happy with their present weight and

are, by far, less affected by insomnia. Furthermore, they are able to get the amount of sleep they desire.

Investigative Question Five. How does the use of psychological stress management (PSM) versus the other health practices relate to the amount of fatigue being experienced?

In answering this particular question, a review of the data analysis performed for Investigative Question One was needed. All of the health practices were analyzed and compared with both psychological and physiological fatigue using the SPSS-X Subprogram PEARSON CORR to determine which health practices are statistically significant in their relationship with fatigue. For the health practice of PSM, test results indicated a correlation coefficient of .0210 with p-value equal to .317 for psychological fatigue and .0476 with a p-value of .140 for physiological fatigue. Neither of these relationships are statistically significant at alpha equal to .10.

When looking at the frequencies for both the military and civilian to verify what the respondents' answers were when asked to indicate how often they practice any kind of PSM, it was amazing to notice that over 80 percent of both groups reported 'never' practicing PSM. Only 10.4 percent of the military and even less, 7.4 percent, of the civilian group indicated practicing PSM at least once a week. This small amount of partici-

pation in PSM may very well be the reason for not being able to show any significant relationship between this health practice and either fatigue factor.

Of those reporting that they have tried PSM, even if less than once a month, the majority, 53.7 percent for the military and 53.8 percent of the civilians, indicated the reason for practicing PSM was to release pent-up stress. Two other primary reasons are because they enjoy it and because they were advised to by a physician.

In summary, it appears the the health practice of psychological stress management is not related to the amount of fatigue with any significance and that there are other health practices, as noted for investigative question one, that are more directly related to fatigue. However, the reason for this might be due to the lack of knowledge about participation in PSM and not necessarily that a relationship does not exist.

Investigative Question Six.

What is the level of awareness of both military and civilian personnel as to knowing when fatigue is operating and the related effects of one's fatigue?

The last two questions in the final part of the survey were used to inquire about this type of information (see Appendix A). Basically, the two questions asked respondents to comment on their self-awareness of when experiencing fatigue

and the effects it has, and second, if they felt health practices influenced the amount of fatigue they experienced.

Of the 318 military respondents, 189 commented (59.4%) to some degree on one or both of the questions, as compared to the civilian group where 129 of the 230 respondents (56.1%) provided comments. Not all of the comments could be included in this study but all of them were analyzed and a sample which appeared to be a good cross section of useful comments are provided in Appendix D.

The majority who commented on the first question felt they were aware of when fatigue was upon them and that they knew what the effects of fatigue were on them personally. A substantial portion even provided some of the effects of fatigue they personally encountered.

In regards to the second question on respondents' feelings about the way health practices influenced the amount of fatigue they experienced, the responses varied from not applicable to totally agree to disagree. Those that responded not applicable felt they were not fatigued enough to provide judgement on the statement. For those that agreed to the statement, a large number supplied information on the particular health practice(s) that influenced their fatigue. Those that dis-

agreed generally did not respond to why. They apparently felt that the statement was not accurate for their situation.

Both questions are supplied in Appendix D with their respective comments presented as well. Overall, it appears that there is an awareness of fatigue by those who responded. However, a large percentage did not respond, so what their awareness is will remain a mystery.

Summary

Chapter IV presented an indepth analysis of the results to this study. The overall response was provided along with the demographic profile of the respondents included in the study. Finally a detailed analysis, with various statistical tests, was provided for each of the six investigative questions. The next chapter will address the research hypothesis along with recommendations for future research.

V. Findings and Recommendations

Overview

The purpose of this research was to examine the health practices of higher ranked individuals, both military and civilian, at the Aeronautical Systems Division of the USAF Systems Command (AFSC/ASD) to determine if there is a relationship between the health practices they are following and the amount of fatigue they are experiencing. Seven health practices were studied along with six investigative questions to help test the research hypothesis presented in Chapter I.

This chapter will address the research hypothesis based on the results and analysis of Chapter IV. Finally, several suggested areas for follow-up study will be recommended.

Research Hypothesis

The overall objective of this study was to reject the null hypothesis stated in Chapter I. It said:

There will be no relationship between various health practices followed to the amount of fatigue being experienced.

The testing of this hypothesis relied on the results of the six investigative questions analyzed in Chapter IV. Each

investigative question is briefly reviewed at this time to remind the readers of those results.

Investigative Question One. Are the following health practices related to the amount of fatigue being experienced?

- a) alcohol consumption
- b) caffeine consumption
- c) amount of exercise
- d) eating habits
- e) sleeping habits
- f) smoking habits
- g) psychological stress management

Initially, factor analysis was used to separate fatigue into the two dimensions of psychological fatigue and physiological fatigue. This was done to simplify further analysis on the data. These two fatigue factors were then compared to various health practices to determine if a relationship exists.

Overall, there was a statistical significance, for alpha equal to .05, in the direct relationship between the following health practices to at least one of the two fatigue factors: Frequency and quantity of alcohol consumption; Frequency and quantity of caffeine consumption; strenuous physical activity and relaxing with mind activities for amount of exercise; Fat intake, water consumption, and actual versus desired weight for eating habits; Quantity of sleep, affected by insomnia, and

actual versus desired sleep for sleeping habits. There did not appear to be any direct relationship of smoking habits or psychological stress management to either fatigue factor.

Investigative Question Two. How does the fatigue level of military personnel compare to that of civilian personnel?

Using a significance level of .05, the ANOVA test showed that there was not a statistically significant difference between the responses of military and civilian groups. That is, there appeared to be similar fatigue levels, for both fatigue factors, within each group.

Investigative Question Three. What are the major differences in the health practices followed by military personnel as compared to that of civilian personnel?

A Kolomogorov-Smirnov (K-S) test which tested the distributions of responses for both groups indicated, for a significance level of .05, there was only one health practice that was statistically significant. The health practice of strenuous physical activity appeared to be the only health practice which had major differences in the responses by the military group versus the civilian group.

Performing crosstabulations on the frequencies of each response indicated the military group participates much more frequently in strenuous physical exercise than their civilian counterparts. For example, 49.4 percent of the military parti-

cipate at least three times a week as compared to 32.3 percent for the civilian group.

Investigative Question Four. What are some of the health practices followed by those reporting minimum amounts of fatigue?

After separating the respondents into two groups, one for low and one for high fatigue, for each fatigue factor, the Kolomogorov-Smirnov test was again used to test for statistically significant differences in the distribution of responses for each health practice. In summary, those reporting low fatigue in either the psychological or physiological dimension appear to be consuming less alcohol and caffeine, participating more often in strenuous physical activities, and relaxing with some form of mind activity. These respondents are also more happy with their present weight and are, by far, less affected by insomnia. Furthermore, they state they are able to get the amount of sleep they desire.

Investigative Question Five. How does the use of psychological stress management (PSM) versus the other health practices relate to the amount of fatigue being experienced?

From this sample of respondents it is nearly impossible to tell if using PSM is related to fatigue level. This is because over 80 percent of the respondents reported never practicing

any kind of PSM. If more had participated, at any frequency, results may have been different; but as it is, there is no direct relationship with any significance between PSM and either the psychological or physiological fatigue factor.

Investigative Question Six. What is the level of awareness of both military and civilian personnel as to knowing when fatigue is operating and the related effects of one's fatigue?

Basically, respondents who commented to the statements related to this question felt they were aware of when fatigue was setting in because they knew the effects it had on them. There were mixed feelings as to agreeing if health practices influenced the amount of fatigue. Some gave examples of health practices that helped alleviate their fatigue while others simply stated it was not true. It appears that both groups are aware of fatigue and its effects; however, there was a large percentage who did not comment or supply their feelings on this matter, so it is unreasonable to conclude that all are aware of fatigue and its effects.

Now that the investigative questions have been reviewed, it appears that investigative questions one and four give the majority of the support for rejecting the null hypothesis for this research. That is, the statement that "there will be no relationship ..." is rejected based on evidence that various

health practices did indeed have a direct relationship with both psychological and physiological fatigue. In addition, there were certain health practices that had considerable differences in responses for the low fatigue group when compared to the high fatigue group.

It was also interesting to note the consistency between investigative question two and three. For example, investigative question two indicated there was no significant difference in the fatigue levels of military and civilian personnel, while investigative question three showed that of all the health practices studied only one, strenuous physical activity, was known to have a significant difference between the military and civilian groups. This promotes the assumption that if similiar health practices are being followed then similar fatigue levels should be present no matter who they pertain to - military or civilian personnel.

Finally, the comments provided by the respondents' suggest that they can control the fatigue they feel by following certain health practices. A great deal say they know when fatigue is operating, what its effects are, and how to go about handling it.

Recommendations for Further Research

There are many opportunities for further research in the area of health practices and its relationship to fatigue. First of all, a different population at AFSC/ASD can be targeted, such as younger officers and NCO's, as well as lower grade civilians. Comparisons can then be made in both the health practices and fatigue levels and then with the overall results of the relationship between the two.

Second, the study can be conducted at different commands within the Air Force to investigate various fatigue levels and the awareness of fatigue and make between command comparisons.

The third recommendation is to expand on the fatigue related questions to get a better overall assessment of fatigue levels before studying the relationship of fatigue to health practices.

A final recommendation is to do a medical analysis of physiological fatigue to determine the level of fatigue in relation to various health practices.

Summary

The overall health of employees can have significant impact on efficiency and effectiveness of performance. If a person is fatigued at work they will not be able to perform at

peak performance. This research provides information as to how health practices can cause or alleviate fatigue. If a person is aware of their fatigue by knowing its effect on them, then they will be able to follow certain health practices that work for them to help alleviate or even prevent fatigue from setting in.

The data provided by the respondents' located at AFSC/ASD provided evidence to suggest there is a direct relationship between some health practices and fatigue levels. If the awareness of this relationship can be expanded, then more individuals will understand how to handle fatigue, resulting in better health and increased performance. Pursuing this expansion would only significantly enhance the readiness of the work force.

Appendix A: Health Practices and Fatigue Survey



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY
WRIGHT-PATTERSON AIR FORCE BASE OH 45433-4553

20 MAY 1988

REPLY TO
ATTN OF: LS (Capt Kennedy, 56569)

SUBJECT: Health Practices and Fatigue Survey

TO: Respondents

1. Please take the time to complete the attached questionnaire on the enclosed answer sheet and return it in the envelope provided within seven days of receipt. Names are not required on the answer sheet, allowing your responses to be anonymous.
2. The purpose of this survey is to examine the relationship between the health practices being followed and the amount of fatigue one is under. Your participation in this study may help to determine if an awareness in the above stated relationship can help the individual to control the fatigue level, thus increasing better individual well-being and organizational performance.
3. Participation in this research is voluntary, but we would certainly appreciate your help. Your individual response will be combined with others and will not be attributed to you personally.
4. If you would like to see the results to this study, then fill in and tear off the bottom portion of this letter and return to Capt S. Kennedy, AFIT/LSY. Thank you very much for your support.

WILLIAM A. MAUER
Associate Dean
School of Systems and Logistics

3 Atch
1. Questionnaire
2. Answer Sheet
3. Return Envelope

YES, I would like to see the results to this survey.

My name and office symbol are:

STRENGTH THROUGH KNOWLEDGE

PART I

THIS PART OF THE QUESTIONNAIRE PERTAINS TO YOUR
BACKGROUND AND CURRENT JOB INFORMATION

1. What is your rank/grade?

- | | |
|---------------|---------------------------|
| 1. Major | 5. GM/GS-14 |
| 2. Lt Colonel | 6. GM/GS-15 |
| 3. Colonel | 7. Other - Please specify |
| 4. GM/GS-13 | |
-

2. What is your sex?

- | | |
|---------|-----------|
| 1. Male | 2. Female |
|---------|-----------|

3. What age group are you in?

- | | |
|------------------|----------------|
| 1. 30 or younger | 5. 46-50 |
| 2. 31-35 | 6. 51-55 |
| 3. 36-40 | 7. 56-60 |
| 4. 41-45 | 8. 61 or older |

4. In what area is your current job most associated?

1. Program Management
2. Configuration/Data Management
3. Test/Evaluation
4. Engineering
5. Manufacturing Production
6. Logistics
7. Program Control
8. Operations/Support
9. Integration
10. Other - Please specify: _____

5. How many years have you been in this current area of work?

- | | |
|----------------|------------|
| 1. Less than 1 | 5. 7-8 |
| 2. 1-2 | 6. 9-10 |
| 3. 3-4 | 7. over 10 |
| 4. 5-6 | |

6. How many people work directly under you?

- | | |
|----------|------------|
| 1. 0-5 | 6. 26-30 |
| 2. 6-10 | 7. 31-35 |
| 3. 11-15 | 8. 36-40 |
| 4. 16-20 | 9. over 40 |
| 5. 21-25 | |

7. Please indicate your current job title (it doesn't need to be program specific): _____

PART II

THIS PART OF THE QUESTIONNAIRE PERTAINS TO YOUR
CURRENT HEALTH PRACTICES

8. How often do you drink alcoholic beverages?

1. Never
2. Less than once every 2 or 3 months
3. Once every 2 or 3 months
4. About once a month
5. About once every 2 or 3 weeks
6. Once a week
7. 2 or 3 times a week
8. 4 or 5 times a week
9. Almost every day
10. Every day

9. On the average, how many drinks do you usually consume for each occasion selected above (drinks include beer, glass of wine, a shot, or mixed drinks)

1. Don't drink
2. 1 drink
3. 2 drinks
4. 3 drinks
5. 4 drinks
6. 5 drinks
7. 6 drinks
8. 7 drinks
9. 8 drinks
10. more than 8 drinks

10. How often do you drink caffeinated beverages?

1. Never
2. About once a month
3. About once a week
4. 3 to 5 times a week
5. About once a day
6. About twice a day
7. More than twice a day

11. On the average, how many drinks do you usually consume for each occasion selected above (drinks include cups of coffee or tea, cans or bottles of soda)

1. Don't drink
2. 1 drink
3. 2 drinks
4. 3 drinks
5. 4 drinks
6. 5 drinks
7. 6 drinks
8. more than 6 drinks

12. How often do you participate in forms of exercise that require strenuous physical activity for at least 20 minutes per session? (e.g. swimming, running, aerobics, weight lifting, etc)

1. Almost every day
2. About 3-5 times per week
3. About 1-2 times per week
4. About 1-3 times per month
5. Less than once a month
6. Never

13. How often do you participate in forms of exercise that do not require strenuous physical activity? (e.g. golfing, bowling, walking, volleyball, etc.)

1. Almost every day
2. About 3-5 times per week
3. About 1-2 times per week
4. About 1-3 times per month
5. Less than once a month
6. Never

14. How often do you try to relax with some form of mind activity? (e.g. reading, music, crafts, chess, etc.)

1. Almost every day
2. About 3-5 times per week
3. About 1-2 times per week
4. About 1-3 times per month
5. Less than once a month
6. Never

15. From the list below, what is the main reason you exercise?

1. Not applicable; I do not exercise
2. I enjoy it
3. To meet Air Force requirements
4. I was told to do so by a physician
5. To control my weight
6. It is necessary for good health
7. To release pent-up stress
8. To occupy my time - boredom
9. Other - Please Specify: _____

16. How calorie conscious are you?

1. I pay little or no attention to how many calories I eat
2. Occasionally I try to keep track of how many calories I eat
3. I usually try to keep a rough count of how many calories I eat
4. I closely watch and control the number of calories I eat

17. Do you try to control the amount of fat you eat?
1. Yes, I control my intake closely
 2. Yes, I control my intake somewhat
 3. No, I do not control my intake
18. Do you try to control the amount of protein you eat?
1. Yes, I control my intake closely
 2. Yes, I control my intake somewhat
 3. No, I do not control my intake
19. Do you try to control the amount of carbohydrates you eat?
1. Yes, I control my intake closely
 2. Yes, I control my intake somewhat
 3. No, I do not control my intake
20. Do you try to control the amount of fiber you eat?
1. Yes, I control my intake closely
 2. Yes, I control my intake somewhat
 3. No, I do not control my intake
21. Have you had your blood tested for cholesterol within the last two years?
1. No
 2. Yes, and the results indicated no problem
 3. Yes, and the results indicated a problem
 4. Yes, but I never got the results
 5. Don't remember
22. On the average, how many times per week do you eat breakfast?
- | | |
|------|------|
| 1. 0 | 5. 4 |
| 2. 1 | 6. 5 |
| 3. 2 | 7. 6 |
| 4. 3 | 8. 7 |
23. On the average, how many glasses of water do you have each day?
- | | |
|--------|--------------|
| 1. 0-1 | 4. 6-7 |
| 2. 2-3 | 5. 8 or more |
| 3. 4-5 | |
24. How often do you take vitamin supplements?
1. Never
 2. About once a month
 3. About once a week
 4. Only a few times a week
 5. Almost every day
 6. Every day
 7. More than once a day

25. Comparing your present weight with what you would like to weigh, how would you rate yourself?

1. Very overweight
2. Slightly overweight
3. About Right
4. Slightly underweight
5. Very underweight

26. On the average, how many hours do you usually sleep each night?

- | | |
|--------------|---------------|
| 1. 4 or less | 5. 8 |
| 2. 5 | 6. 9 |
| 3. 6 | 7. 10 or more |
| 4. 7 | |

27. How often are you affected by insomnia? (not being able to fall asleep or waking up for no reason and not able to go back to sleep)

1. Never
2. About once every four months
3. Once every 2-4 months
4. About once a month
5. About once every 2-3 weeks
6. Once a week
7. 2-3 times a week
8. 4-5 times a week
9. Almost every night
10. Every night

28. On a weekly basis, how often do you get less than your desired amount of sleep a night?

1. I never get enough sleep
2. Too often I don't get enough sleep
3. Almost every night I usually get all the sleep I need
4. I always get enough sleep

29. Do you smoke cigarettes, cigars, a pipe, or chew tobacco?

1. No, I have never smoked or chewed
2. No, I used to smoke/chew but I quit over a year ago
3. No, I used to smoke/chew but I quit less than a year ago
4. Yes, less than 1/2 pack/can per day
5. Yes, 1/2 to 1 pack/can per day
6. Yes, 1 to 2 packs/cans per day
7. Yes, more than two packs/cans per day

30. Do you practice any kind of psychological stress management (e.g. yoga, meditation, biofeedback, counseling, etc.)

1. Never
2. Less than once a month
3. About once a month
4. About every 2-3 weeks
5. Once a week
6. 2-3 times a week
7. 4-5 times a week
8. Almost every day
9. Every day
10. More than once a day

31. What is the main reason for practicing psychological stress management?

1. Not applicable; I do not practice any
2. I enjoy it
3. I was told to do so by a physician
4. It is necessary for good health
5. To release pent-up stress
6. To occupy my time - boredom
7. Other - Please Specify: _____

PART III

THIS PART OF THE QUESTIONNAIRE PERTAINS TO
POSSIBLE STRESSORS IN YOUR LIFE

32. How severe do you consider your personal, emotional, behavioral, or mental problems that concerned you in the last 24 months?

1. No problems
2. Not very
3. Somewhat
4. Quite
5. Very

33. From the list below, indicate all the events that have occurred in your life within the last 24 months.

1. Death of a spouse
2. Divorce
3. Marital separation
4. Jail term/conflicts with the law
5. Death of a close family member
6. Personal injury or illness
7. Marriage
8. Fired from last job
9. Marital reconciliation
10. Change in health of family member

34. From the list below, indicate all the events that have occurred in your life within the last 24 months.

1. Pregnancy (yourself/spouse)
2. Sex difficulties
3. Gain of new family member
4. Business adjustment
5. Change in financial state
6. Death of a close friend
7. Change to different line of work
8. Change in the number of arguments with spouse
9. Foreclosure of mortgage or loan
10. Change in responsibilities at work

35. From the list below, indicate all the events that have occurred in your life within the last 24 months.

1. Outstanding personal achievement
2. Begin or end school
3. Change in living conditions
4. Trouble with boss
5. Change in work hours or conditions
6. Change in residence
7. Change in recreation
8. Change in amount of physical activity related to work (climbing stairs, walking great distances, etc)
9. Other major event causing extreme stress -
Please specify: _____

PART IV

THIS PART OF THE QUESTIONNAIRE WILL ATTEMPT
TO MEASURE YOUR FATIGUE

36. Compared to other people your age would you say you have:
1. Much less energy
 2. Somewhat less energy
 3. About equal energy
 4. Somewhat more energy
 5. Much more energy
37. How have you changed your alcohol drinking pattern during the past 24 months because of stress related events?
1. Drink a lot more
 2. Drink slightly more
 3. Haven't changed drinking pattern
 4. Drink slightly less
 5. Drink a lot less
 6. Don't drink alcohol
38. How have you changed your caffeine drinking pattern during the past 24 months because of stress related events?
1. Drink a lot more
 2. Drink slightly more
 3. Haven't changed drinking pattern
 4. Drink slightly less
 5. Drink a lot less
 6. Don't drink caffeine
39. How have you changed your smoking/chewing pattern during the past 24 months because of stress related events?
1. Smoke/chew a lot more
 2. Smoke/chew slightly more
 3. Haven't changed smoking/chewing pattern
 4. Smoke/chew slightly less
 5. Smoke/chew a lot less
 6. Don't smoke/chew
40. How have you changed your eating pattern during the past 24 months because of stress related events?
1. Eat a lot more
 2. Eat slightly more
 3. Haven't changed eating pattern
 4. Eat slightly less
 5. Eat a lot less

49. Please use this portion of the survey to present comments that you have on the statement, "I am aware of when I am experiencing fatigue and what the effects of fatigue are on me personally".

50. Please use this portion of the survey to present comments that you have on the statement, "Health practices, past or present, have influenced the amount of fatigue I was/am experiencing".

THANK-YOU VERY MUCH FOR TAKING THE TIME TO COMPLETE THIS SURVEY
(I hope it didn't add to the amount of stress you are under)

Appendix B: Psychological Frequency Tables on Significant Health Practices for Low and High Fatigue Groups

TABLE B.1

Crosstabulation of Quantity of Alcohol Consumption by Low and High Fatigue Groups

Category	<u>Low</u>		<u>High</u>	
	Count	Percentage	Count	Percentage
Do not drink	10	11.6	7	9.9
1 drink	30	34.9	10	14.1
2 drinks	38	44.2	34	47.9
3 drinks	3	3.5	12	16.9
4 drinks	4	4.6	5	7.0
5 drinks	1	1.2	2	2.8
6 drinks	0	-	0	-
7 drinks	0	-	1	1.4
Total	86	100.0	71	100.0

TABLE B.2

Crosstabulation of Frequency of Caffeine
Consumption by Low and High Fatigue Groups

Category	<u>Low</u>		<u>High</u>	
	Count	Percentage	Count	Percentage
Never	3	3.5	1	1.4
About once a month	4	4.6	2	2.8
About once a week	9	10.5	2	2.8
3 - 5 times/week	7	8.1	9	12.7
About once a day	21	24.4	12	16.9
About twice a day	20	23.3	10	14.1
More than twice a day	22	25.6	35	49.3
Total	86	100.0	71	100.0

TABLE B.3

Crosstabulation of Quantity of Caffeine
Consumption by Low and High Fatigue Groups

Category	<u>Low</u>		<u>High</u>	
	Count	Percentage	Count	Percentage
Do not drink	3	3.5	3	4.2
1 drink	50	58.1	24	33.8
2 drinks	19	22.1	18	25.4
3 drinks	7	8.1	8	11.3
4 drinks	2	2.3	6	8.5
5 drinks	1	1.2	5	7.0
6 drinks	0	-	3	4.2
More than 6 drinks	4	4.7	4	5.6
Total	86	100.0	71	100.0

TABLE B.4

Crosstabulation of Relaxing with Mind
Activities by Low and High Fatigue Groups

Category	<u>Low</u>		<u>High</u>	
	Count	Percentage	Count	Percentage
Almost every day	53	61.6	21	29.6
3 - 5 times/week	12	13.9	7	9.8
1 - 2 times/week	14	16.3	20	28.2
1 - 3 times/week	3	3.5	10	14.1
Less than once a month	3	3.5	9	12.7
Never	1	1.2	4	5.6
Total	86	100.0	71	100.0

TABLE B.5

Crosstabulation of Affected by Insomnia
by Low and High Fatigue Groups

Category	<u>Low</u>		<u>High</u>	
	Count	Percentage	Count	Percentage
Never	40	46.5	12	16.9
About once every 4 months	23	26.7	15	21.1
About once every 2 - 4 months	8	9.3	8	11.3
About once a month	9	10.5	8	11.3
About once every 2 - 3 weeks	3	3.5	13	18.3
Once a week	3	3.5	6	8.4
2 - 3 times/week	0	-	7	9.9
4 - 5 times/week	0	-	1	1.4
Almost every night	0	-	1	1.4
Total	86	100.0	71	100.0

TABLE B.6

Crosstabulation of Actual vs Desired
Sleep by Low and High Fatigue Groups

Category	<u>Low</u>		<u>High</u>	
	Count	Percentage	Count	Percentage
Always get enough	10	11.6	1	1.4
Usually get enough	63	73.2	25	35.2
Too often don't get enough	12	14.0	40	56.4
Never get enough	1	1.2	5	7.0
Total	86	100.0	71	100.0

Appendix C: Physiological Frequency Tables on Significant Health Practices for Low and High Fatigue Levels

TABLE C.1

Crosstabulation of Strenuous Physical Activity
by Low and High Fatigue Groups

Category	Low		High	
	Count	Percentage	Count	Percentage
Every day	16	25.8	4	4.6
3 - 5 times/weeks	15	24.2	23	26.5
1 - 2 times/week	7	11.3	10	11.5
1 - 3 times/month	6	9.7	14	16.1
Less than once a month	10	16.1	25	28.7
Never	8	12.9	11	12.6
Total	62	100.0	87	100.0

TABLE C.2

Crosstabulation of Relaxing with Mind
Activities by Low and High Fatigue Groups

Category	Low		High	
	Count	Percentage	Count	Percentage
Everyday	37	59.7	34	39.1
3 - 5 times/week	8	12.9	11	12.6
1 - 2 times/week	10	16.1	21	24.1
1 - 3 times/month	4	6.5	8	9.3
Less than once a month	2	3.2	11	12.6
Never	1	1.6	2	2.3
Total	62	100.0	87	100.0

TABLE C.3

Crosstabulation of Current versus Desired
Weight by Low and High Fatigue Groups

Category	Low		High	
	Count	Percentage	Count	Percentage
Very Overweight	4	6.5	14	16.1
Slightly Overweight	30	48.4	52	59.8
About Right	27	43.5	16	18.4
Slightly Underweight	1	1.6	5	5.7
Very Underweight	0	-	0	-
Total	62	100.0	87	100.0

TABLE C.4

Crosstabulation of Affected by Insomnia
by Low and High Fatigue Groups

Category	Low		High	
	Count	Percentage	Count	Percentage
Never	34	54.8	12	13.8
Once every 4 months	11	17.8	18	20.7
Once every 2-4 months	7	11.3	11	12.7
Once a month	3	4.8	17	19.5
Once every 2-3 weeks	4	6.5	10	11.5
Once a week	2	3.2	8	9.2
2-3 times/week	1	1.6	7	8.0
4-5 times/week	0	-	2	2.3
Almost every night	0	-	2	2.3
Total	62	100.0	87	100.0

TABLE C.5

Crosstabulation of Actual VS Desired
Sleep by Low and High Fatigue Groups

Category	Low		High	
	Count	Percentage	Count	Percentage
Always get enough	4	6.5	2	2.3
Usually get enough	50	80.6	26	29.9
Too often don't get enough	7	11.3	51	58.6
Never get enough	1	1.6	8	9.2
Total	62	100.0	87	100.0

Appendix D: Selected Survey Comments

QUESTION 1: PRESENT COMMENTS ON THE STATEMENT "I AM AWARE OF WHEN I AM EXPERIENCING FATIGUE AND WHAT THE EFFECTS OF FATIGUE ARE ON ME PERSONALLY".

Civilian

- Lack of energy when fatigued.
- When I'm fatigued I don't feel like doing much and I become more short-tempered and impatient.
- I am generally aware. I become irritable, short-tempered, and not very pleasant. I go off by myself.
- Fatigue symptoms are well recognized; therefore, I can back off schedule as required.
- A "10" minute nap usually solves fatigue.
- The statement is true but I am not knowledgeable on all aspects of fatigue.
- Physical fatigue experienced, not emotional fatigue, is consistent with my age, And, in my opinion, is not a concern, nor expected to be a concern for many more years.
- I have come to a place in my life where I pay close attention to how I feel, mentally and physically, so I agree with the statement completely.
- I experience fatigue every day and just have to deal with it.
- I am not very good at determining my level of fatigue.
- Generally true, all too often, but I haven't been able to do anything about it.
- Personal effects are lethargy and an inability to concentrate.

- Fatigue produces a lazy feeling with no interest in doing any physical activity. If working under fatigue, I become irritable and short-tempered.
- I don't think about fatigue and am not aware of any personal effects.
- Fatigue generally tends to diminish your ability to consider all factors as well as objectivity.
- On the rare occasion when I feel fatigued, I procrastinate.
- Fatigue, especially when accompanied by hunger, tends to make me short-tempered, particularly with my family. Fatigue, in my case tends to be directly related to how much sleep I am getting. With enough sleep, I can rapidly recover from a particularly exhausting day.
- I am generally not aware of fatigue and its impact.
- Fatigue is no excuse for not accomplishing necessary tasks.
- Often I'm not aware of fatigue effects until it hits an extreme.

Military

- When I am fatigued, really fatigued, my head hurts. In such cases I will take a weekend off and do very little. This gives my body a chance to recuperate.
- Completely agree. Also, when I am tired I rest. It's like I have a "built-in" fatigue monitor that makes me go to sleep and rest when fatigue is high.
- I am aware of experiencing fatigue; however, I assume that its effects on me are the same as on other people. Specifically, difficulty in concentrating on the task at hand.

- Not always true. Tends to be ignored until very late in the work day.
- I push right through fatigue, as the job must get done and suspenses met.
- Fatigue makes me lethargic and apathetic to deal with issues in my life.
- I am ususlly aware but the effects are not always obvious.
- Fatigue can adversely affect anyones behavior and/or ability to do their job. I try to adjust my schedule to control fatigue and stay in as good as shape as possible to deal with fatigue when it occurs.
- Usually true but the awareness doesn't help much.
- Although unaware of all the effects of fatigue, I know when to back off physically. However, more often then not I am not aware when to back off due to mental fatigue.
- Agree strongly. I am very attuned to my physical state and the psychological effects of that state.
- A little fatigue after a long day at work is normal. Extreme fatigue can lead to poor judgement in decision making. Important to not get into a situation of extreme fatigue. Do so by getting away from job for a short while, or vary the tasks to provide variety.
- I very rarely experience fatigue but, when I do I try and relax and take care of it right away.
- When fatigued I get edgy, nervous, and very short tempered.
- Rarely experience fatigue so I do not know the effects of fatigue on me personally.
- The statement is true. I carefully monitor my fatigue. I am always in energy debt; but when it gets too rough I splurge and sleep 10 hours one night.

- I determined it is useless to proceed with what I am involved in at the moment. I cease the effort and look to exercise or sleep. If I am unable to cease I make a personal mental note that I am operating in a less than optimum state.
- True statement. Knowing when you are fatigued and therefore stressed can make you more aware and alert for reactions which are atypical. If you recognize it, you can keep from making remarks or over reacting to situations.
- Fatigue can be crippling in the work environment at ASD. The ASD work environment perpetuates the problem.
- I think I am aware of the outward signs of fatigue. Once fatigued, I can not say that I know what the mental effects are.
- True. One would have to be badly out of touch with one's self for this not to be true.

QUESTION 2: PRESENT COMMENTS ON THE STATEMENT "HEALTH PRACTICES, PAST OR PRESENT, HAVE INFLUENCED THE AMOUNT OF FATIGUE I WAS/AM EXPERIENCING".

Civilian

- I expect that my current mental and physical health practices prevent fatigue since I rarely experience it.
- I believe vitamins plus moderate exercise (walking) has kept me from frequent episodes of fatigue.
- I agree somewhat only if health practices covers mental in addition to physical and food/liquid intakes.
- True. Caffeine keeps me awake at night causing lack of sleep resulting in fatigue the next day.
- True statement. Exercise, eating, drinking, and sleeping habits definitely impact on your capability to combat fatigue.
- Could be, I don't know. I believe I am a health-minded person, aware of what I must do/eat.
- I have not varied my health practices to determine any correlation with fatigue.
- I do not see a relationship.
- Exercise has no effect on my level of fatigue.
- Definitely true, but high stress itself to a certain extent promotes bad health practices, which in turn promotes fatigue.
- I find that at times past when I have been on diets with low calorie intake and very little bread and eat a lot of fruit I feel much less fatigue and seem to have more energy.
- Poor eating habits lowers fatigue symptom thresholds.

- As a result of exercising and meditation I have reduced the negative effects of stress and have increased my capacity for stress but am not in total control which continues to have some fatiguing effects.
- I quit smoking nine years ago and know my present energy benefitted. While I don't exercise, I am energetic and active and don't get tired.
- As I've put on additional bodyweight I find I become fatigued more easily.
- During times when I have practiced yoga, spent time biking, running, or walking, I have experienced less fatigue in day to day life and seem to have more energy.
- Certainly, a reduction in alcohol consumption and weight loss have increased my energy level.
- Health practices usually don't effect fatigue except for loss/non sleep.
- Health has had no bearing. Stress is tiring - I can manage it.

Military

- Fatigue is not always a matter of physical health. Mental health is equally important. I believe in mind over matter.
- To a degree this is true, but work load and personal demands on my time are larger factors.
- My health practices have not affected or influenced my fatigue level. I have always been able to keep fatigue out.
- Agree. My physical fitness and weight are definitely factors in the amount of fatigue I experience.
- I haven't noticed any relationship.

- I think rest, proper meals, and exercise are the keys to lowering your fatigue.
- I find physical exercise clears my mind and reenergizes me. I watch my weight, been cutting back on soda because of the sugar. Occasionally, take blood pressure to keep below concerned thresholds and reduced salt intake.
- Positive health practices and fatigue should be inversely related. However, fatigue can be caused by causes other than health practices. I feel that my fatigue is created by mental reasons than physical. Exercise won't make the situation change; therefore, I don't believe health practices will/have influenced fatigue.
- Little to do with it. Work environment and age are responsible.
- Eating less, more exercise, and good sleep habits have increased my general well being and do help eliminate symptoms of fatigue.
- Disagree. I believe current everyday stress is a bigger factor for me personally as I've always practiced "good health habits".
- I feel daily walking is very beneficial.
- Certainly. One becomes more sensible about health practices when educated on the subject. I have accepted that when a body needs rest don't push it. Fatigue can cause over reaction to stimulants such as caffeine. Be aware, recognize, practice.
- I certainly think that the better shape I am in, the less fatigue I experience.
- Vigorous exercise was started 10 years ago to overcome a fatigue problem.
- Exercise consistently gives me more energy, esteem, etc., and directly contributes to productivity. An offshoot of this process is a reduction of stress overall.

- Present health practices have significantly improved my fatigue tolerance.
- Energy only comes from great health habits. Energy is essential to the job.
- I am trying to eat three times a day, cut fat and caffeine intake, and improve my exercising - all seem to decrease fatigue.
- Lack of significant strenuous exercise and cigarette smoking surely contribute to my occasional fatigue.
- Healthier mind and body reduces fatigue.
- I don't know. I haven't been more or less fatigued since I began limiting fat intake and stopped smoking.
- After taking up jogging 10 years ago, I have just about eliminated fatigue from my work day.
- I strongly agree. Having never indulged in alcohol, nicotine, and caffeine is a very positive step in eliminating fatigue. This, in conjunction with catnaps are my key to a healthy mental and physical state.
- True, I've begun a walking program and it does generally make me feel better.
- Little effect, at least in the short term.
- Use of moderate exercise, mental biofeedback, and vitamins reduce fatigue.
- A good exercise program invigorates the rest of my day and extra weight decreases my endurance and introduces fatigue.

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It is important for personnel within the DOD to be aware of how stress combined with various health practices may be causing or adding to the level of fatigue one experiences. If fatigue is controlled, the result may be better overall work performance and efficiency.

The intention of this research was to examine the health practices of higher ranked individuals, both military and civilian, at Aeronautical Systems Division to determine if a relationship exists between the health practices they are following and the amount of fatigue they are experiencing. The health practices studied were: alcohol consumption, caffeine consumption, amount of exercise, eating habits, sleeping habits, smoking habits, and psychological stress management. These seven health practices were analyzed and compared to the amount of fatigue being experienced for both psychological and physiological fatigue. The level of fatigue was determined by individual responses to subjective self-analysis questions. Comparisons were also made between military and civilian personnel to determine if significant differences existed in health practices or in levels of fatigue. *Theses (Dr.)*

Results of the study showed that various health practices have a direct, significant relationship with both psychological and physiological fatigue. In addition, certain health practices had considerable differences in responses for those with low fatigue when compared to those with high fatigue.

The data also indicated there was no significant difference in the fatigue levels of military and civilian personnel. Furthermore, only one health practice, strenuous physical activity, was significantly different between the military and civilian groups.

Finally, the respondents' comments suggest they can control the fatigue they feel by following certain health practices. A large percentage reported they knew when fatigue was operating, what its effects were, and how to go about handling it.

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